LCA Policy Processes

Are Life Cycle Assessments a Threat to Sound Public Policy Making?

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Abstract

This paper deals with the question of whether Life Cycle Assessments (LCAs), with their focus on objective and quantitative results, are the best way to support public policy processes. The public policy making process is characterized as a continuous discoursive struggle. Criteria are defined to distinguish between good and bad public policy discourses to judge the effects of LCA on the public policy process. Many policy scientists argue that methodologies that emphasize quantification and the use of formal methods are not beneficial for sound public policy making. An empirical report of the role LCAs played in public policy making processes on PVC and chlorine in the Netherlands is made to evaluate the contribution of LCAs to public policy making processes and to identify the main limitations of the current LCA methodologies and practices. It appears that political actors tend to use LCAs in a polarizing way. LCAs are easily misused due to their apparent objectivity, and the quantitative and black box nature of their results. LCAs contain an implicit, normative frame that does not match the environmentalists' perception on the kind of evidence needed on toxic effects of organochlorines, which reduced the open nature of the Dutch PVC debate. It is recommended to develop a methodology for product evaluation that approaches the issue in a more open and emergent way to prevent "premature closure" of the analysis. It is expected that a focus on the development of balanced, rich arguments on facts and values in the study process will be more fruitful than the calculation of integral, quantitative indicators.

Keywords: Discourse theory, public policy making, LCA; discussion instrument, public policy making, LCA; Life Cycle Assessment (LCA), public policy making; objectivity, public policy making, LCA; premature closure, framing; public policy making, objectivity, LCA; rational theory, public policy making, LCA

1 Introduction

Life Cycle Assessments (LCAs) have been made to inform and support policy makers involved in the formulation of governmental environmental product-oriented policies such as ecotaxes and ecolabeling. It is hoped that the rankings and ecoprofiles generated by LCAs enable policy makers to make better policies. First experiences, however, have shown that the use of LCAs in public policy making processes is not without problems. It is therefore interesting to address the following question: Are LCAs that focus on formal rankings and quantitative ecoprofiles the best way to support public policy making processes on product oriented environmental measures?

To answer this question, insight into the nature of LCAs, the nature of public policy making processes and into the effects of LCAs on public policy processes is required. This is visualized in **Figure 1**. Insights from the policy sciences are applied to understand the value of LCAs for public policy processes (DELEON, 1994). Information from the policy analysis discipline is of special relevance. This is a subdivision of the policy sciences, which focuses on studies to support and inform policy makers (MISER and QUADE, 1985; 1988).

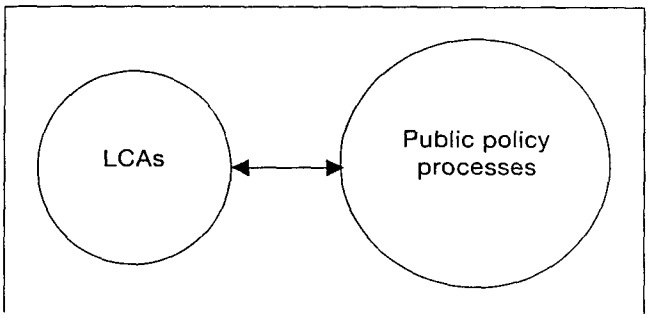

Fig. 1: LCAs and their relation to public policy processes

Section 2 describes the discourse theory, which emphasizes the network nature of public policy processes and frame-dependent nature of knowledge. The discourse theory stresses the need for a open and communicative discussion in which actors learn about each other's perceptions on the issues at hand. The LCA methodology is however inspired by another theory on sound policy making and analysis known as the rational theory, in which quantification and objectivity is emphasized. Many policy scientists argue that this is, however, not beneficial for an open and communicative discussion. An empirical report of the role LCAs played in public policy making processes on PVC and chlorine in the Netherlands is provided in sections 4, 5, and 6. This report in section 7 is used to identify and explain limitations of the current LCA methodologies and practices. It appears that political actors tend to use LCAs in a polarizing way. LCAs

are easily misused due to their apparent objectivity, and the quantitative and black box nature of their results. LCAs contain an implicit, normative frame that do not match the environmentalists' perception on the kind of evidence needed on toxic effects of organochlorines, which reduced the open nature of the Dutch PVC debate. A proposal for a reorientation of the LCA methodology is given in section 8.

2 Public Policy Making

The view one holds on sound policy making and analysis influences greatly what you will see as problematical with regard to the use of LCAs in public policy making processes. My point of departure is the discourse or framing theory (FISCHER and FORESTER, 1993a)[1]. This theory emphasizes the importance of policy networks, argument and framing.

Conflicting frames

In environmental matters, policy networks are formed around governmental, product-oriented policies such as ecotaxes, ecolabels, and banning orders. A policy network consists of actors that interact about policy issues and have a relative stable pattern of relations (DE BRUIJN et al., 1993). Environmental organizations, ministries, consumer organizations, industrial branch associations are often part of these networks. Network actors have often different and even conflicting perceptions of the situation and the desired policy measures. These differences are not only caused by differences in interests, goals and values; but actors may also interpret situations differently due to the use of different frames. Frames are "perspectives from which an amorphous, ill defined, problematic situation can be made sense of and acted on. Framing is a way of selecting, organizing, interpreting, and making sense of, a complex reality to provide guideposts for knowing, analyzing, persuading, and acting" (REIN and SCHÖN, 1993). Paradigms, theories, worldviews or perspectives are also used to refer to frames in the literature.

Different worldviews or frames exist in our society and are used to approach environmental issues[2]. For example, people may use different frames to interpret and cope with environmental risks as explained in the cultural theory (DOUGLAS and WILDAVSKY, 1982; SCHWARZ and THOMPSON, 1990; TESH, 1993; TORGERSON, 1997). TESH distinguishes two frames: a pre-environmentalist one and an environmentalist one[3]. SCHWARZ and THOMPSON visualize these frames as shown in Figure 2.

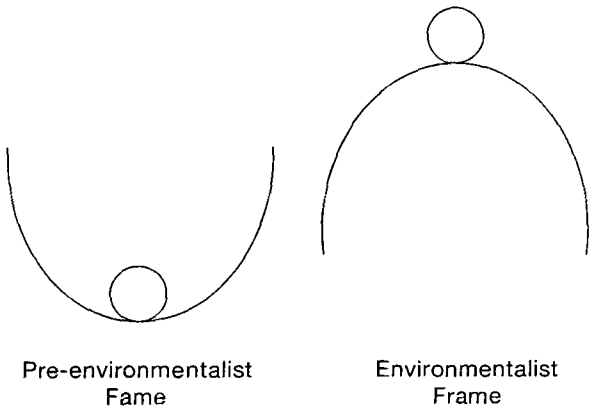

Fig. 2: The pre-environmentalist and environmentalist frame. Source: after SCHWARZ and THOMPSON, 1990, p.147[4]

Pre-environmentalists view the environment as tough and resilient. Nature is relatively stable and can absorb waste products from human activities. Uncertain effects are not a reason to take action because nature is wonderfully forgiving: no matter what knocks we deliver, the ball will always return to the bottom of the basin. Therefore there is no need to act when environmental effects are not fully proven. The environmentalists' frame is fundamentally different. Nature is fragile and there is a delicate balance between human actions and the environment. The least knock of the ball may cause nature's catastrophic collapse. Policy makers and industries should treat the environment with great care and should not take any risks. Uncertain effects should be taken seriously and are a reason to take action. Environmentalists apply a "precautionary" principle.

A sound political argument process

Argument is central in the policy making process according to the discourse theory. The actors in a network are in constant discursive struggle on the nature of the problem and the required policy measures (STONE, 1988; MAJONE, 1989). A number of criteria have been developed to judge the quality of the political argument process in the discourse theory. The political argument process should be open. Ideally, there should be as few restrictions as possible on (DRYZEK, 1993):

- the participation of actors
- the arguments that can be advanced

The actors should hold a real dialogue. The word "dialogue" comes from two Greek roots, dia and logos, suggesting a flow of meaning (JAWORSKY, 1996). In a dialogue, actors learn about the perceptions of other actors, they learn about the key differences between the different perceptions and they learn about their own perception through being confronted with other ideas. This forms the basis for developing con-

[1] Other theories on policy making are the rational theory, mixed scanning, incremental decisionmaking, and the garbage-can model.

[2] Different religions, e.g. Christian, Jewish, Buddhist, Muslim, Animistic, will interpret nature and the relation man-nature differently.

[3] TESH and TORGERSON describe two frames whereas SCHWARZ and THOMPSON describe four frames: nature caprious, nature perverse/tolerant, nature benign and nature ephemeral.

[4] Originally, SCHWARZ and THOMPSON call the pre-environmentalist frame "Nature benign" and the environmentalist one "nature ephemeral".

sensus. Actors may either achieve consensus on the nature of the policy problem and the desired solution or on how to cope with different opinions or perceptions when these do not converge.

Actors should argue in a communicative or reasonable way[5] to achieve a dialogue (HEALEY, 1993; KELLY and MAYNARD-MOODY, 1993; PRÖPPER and BLEIJENBERGH, 1995). Actors argue in a reasonable way when they hold a rich, balanced argument that is directed to the other actors in the policy network. The argument should be designed to convince the other actors of the value of certain ideas and also to clarify the political juxtapositions in a professional way. It is important that an actor tries to imagine the perspective of the other actors, to try and put themselves in the other man's shoes, and be willing to be conciliatory.

Communicative argument is not a matter of fact in political processes. Actors often use strategic argument. PRÖPPER and BLEIJENBERGH (1995) define strategic argument in the following way: actors try to improve their position by winning a discussion in the presence of an audience or the media. To win, actors polarize the discussion by holding forth an exaggerated and simplified argument. In addition, they may apply a number of strategies that exempt them from using arguments concerning the content of the issue. For example, they may mistake the man for the matter or play on supporters of sympathies. Strategic argument yields a debate, in which people try to beat other perceptions down, rather than a dialogue in which people try to understand each other.

Studies are considered as the bearers of arguments that reflect the reasons why different actors disagree about alternative courses of actions available to governments, and as important vehicle for conducting debates. Ideally, studies should stimulate open and rich discussions on multiple perceptions.

3 Rational Features of the LCA Methodology

The development of the LCA methodology has been based, consciously or unconsciously, on a different normative view of sound public policy making and analysis known as the rational theory (LINDBLOM, 1959)[6]. The rational theory and concerns about studies with rational features are explained below.

The formation of public policies is considered sound in the rational theory when it can be explained as a way of choosing of the best means to achieve given goals. An environmental product policy is sound when it is the most efficient way to achieve certain environmental goals. To develop sound public policies, the national government should specify its goals, lay out a broad spectrum of policy alternatives by which the goals can be accomplished, determine the consequences of each alternative, evaluate the alternatives and choose the alternative that maximizes net benefits (MAJONE, 1989; FINDEISEN and QUADE, 1985).

Public policy makers can be supported by studies that analyze and rank alternative policies. Ideally, the results of these studies should be objective, policy relevant, conclusive and simple to use according to the rational theory. In this way they can provide instrumental guidance to policy makers. To achieve this ideal, the study approach should have the following features; these are labeled "rational" features in this article (MAJONE, 1989):

- A means-ends nature
- A comprehensive nature
- An emphasis on quantitative, formal methods and on scientific theories

In a means-ends approach, setting the goals is separated from the analysis of alternatives (→ *Fig. 3*). According to the rational theory, policy makers should set the goals because this is a subjective, value-laden task. Policy makers should clearly define their goals and preferably also the relative values of these goals. Next, they can ask scientists to determine the best alternatives to achieve the politically defined goals. When policy makers are not able to indicate the relative importance of the different goals or when they do not agree on this topic, studies can be used to provide objective scorecards that show the consequences of the alternatives, and policy makers can use these to make formal trade-offs. It is thought that this enables scientists to make studies that are both policy relevant and objective in the rational theory.

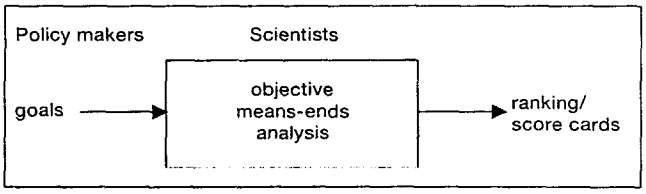

Fig. 3: Division of tasks between policy makers and scientists

The LCA methodology has a means-ends nature. The relationships between the stages in the means-ends model and in the LCA methodology are shown in the **Table 1.**

Table 1: The relationships between the stages in the means-ends model and the LCA methodology

Means-ends model	LCA methodology
Formulating the problem or the objectives	Goal definition
Generating alternatives	Goal definition
Determining the consequences	Impact Assessment
Evaluation	Evaluation
Iteration of the stages	Improvement Assessment

[5] The idea of communicative argument is based on post-modern philosophers such as HABERMAS, ARENDS, and RORTY.

[6] This approach is also known as the rational-comprehensive approach, classic approach, or decisionism.

Studies should be comprehensive according to the rational theory: a broad spectrum of alternatives and relevant effects should be analyzed. This is needed to obtain conclusive rankings. Rankings are not "true" when a number of alternatives or effects are omitted from the analysis. Accordingly, many LCA scientists have stressed the importance of a comprehensive methodology (GUINÉE, 1995; HEIJUNGS et al., 1992).

Finally, the rational approach emphasizes the use of scientific theories and formal, quantitative techniques. There are two reasons for this: Many people consider quantitative methods to be more objective and scientific than qualitative analyses. In addition, a quantitative approach is needed to obtain simple indicators that are easy for policy makers to use and provide clear direction; the LCA methodology was also founded on these basic principles (GUINÉE, 1995; HEIJUNGS et al., 1992).

Reasoning from the discoursive perspective, studies should be considered as discussion instruments rather than providers of conclusive, objective answers. Ideally, studies should contribute to a sound and open political argument process. Studies with rational features are possibly not the best basis for a sound discussion. Many adverse effects of rational studies on political argument processes have been described in the policy science literature (see for example FISCHER and FORESTER, 1993; GUBA and LINCOLN, 1989; LINDBLOM, 1959; MAJONE, 1989; TORGERSON, 1986). It has even been said that rational studies form a threat for open and communicative policy making processes (FISCHER, 1990). LCAs might have the same limitations as other rational studies. From this follows the question that is addressed in this paper: Are LCAs with rational features the best way to support public debates?

4 The Dutch PVC and Chlorine Political Discussion

The use of LCAs in the Dutch chlorine and PVC policy network is described below to get a better understanding of LCAs role in public policy processes on product oriented environmental measures. Discussions regarding the environmental effects of PVC, a plastic made from chlorine, oil and additives, started in the Netherlands in 1989. Eight consumers and environmental organizations organized a joint campaign to restrict, and eventually make illegal, the use of PVC packaging. This campaign induced a political discussion on PVC and the environmental need to replace PVC by other materials (BRAS and MULDER, 1997). As a result a policy, or issue, network came into existence. The key actors in the Dutch PVC-network are[7]:

- Environmental organizations[8]
- PVC-related industries and their organizations[9]
- The Ministry of the Environment[10]

Since 1989, these actor groups have been in constant discursive struggle about the desired PVC policy. The environmental organizations stated that PVC products should be replaced by PVC free ones because of the postulated environmental and health effects of chlorine, and especially, of the dioxins emitted during the production and incineration of PVC. The PVC and chlorine industries argued that replacement was not necessary from an environmental point of view. Improvement of the processes in the PVC chain would solve the few existing problems and might be better for the environment than the replacement of PVC products. The Ministry of the Environment argued that the choice between replacement of PVC and chain improvement should be decided on a product by product basis.

The actor groups did not agree on the following issues[11]:

- the standards that should be applied to persistent, toxic and biomagnifying chlorines: zero or almost zero
- the kind of proof needed to replace PVC: full, scientific proof versus precautionary principle
- the relationship between the incineration of PVC and the emission of dioxins
- the feasibility of PVC recycling
- the risk of transport and fire accidents
- the toxic effects of organochlorine emission: e.g. the generalization of known effects of organochlorines to other organochlorine emissions, and the postulated hormonal effects of organochlorines

The disagreement on the toxic effects of organochlorines and the way these should be proved will be elaborated as an

[7] At times, other actors were involved in this policy network. For example, the Dutch consumers association (De Consumentenbond), the Ministry of Economic Affairs (Ministerie van Economische Zaken) and members of the Dutch Parliament (Tweede Kamer der Staten-Generaal).

[8] Stichting Natuur en Milieu, Vereniging Milieudefensie, Greenpeace Netherlands, Waddenvereniging, Zuid-Hollandse Milieufederatie.

[9] The Association of the Dutch Chemical Industry (Vereniging van Nederlandse Chemische Industrie, VNCI) and the Steering Committee PVC & Environment (Stuurgroep PVC & Milieu) are the main actors. The VNCI is a branch association of the chemical industry. Chlorine, vinyl chloride and PVC-producers and other chemical industries are affiliated to the VNCI. The Steering Committee PVC & Environment was established in 1989 in reaction to the PVC campaign. The members of this group are representatives from the Dutch Federation for Plastic Producers (Nederlandse Federatie voor Kunststoffabrikanten), the Dutch Association of Elastomers and Plastic Converters (Nederlandse Vereniging van Rubber- en Kunststoffabrikanten) and of individual companies producing chlorine, PVC granulate, PVC products, or recycled PVC, e.g. Shell, AKZO, Wavin.

[10] The Directorate General for Environmental Protection of the Ministry of Housing, Spatial Planning and the Environment (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, VROM) is responsible for the Dutch National Environmental Policy. This Directorate General is subdivided into a number of Directorates. The following directorates are involved in the design, formulation and implementation of PVC policies: the Directorate of Waste, the Directorate of Industry, Products and Consumer Policy, and the Directorate of Chemicals, External Safety and Radiation Protection.

[11] The perceptions of the actors were derived from articles in magazines from these actors, e.g. "Greenpeace" and "Nederlandse Chemische Industrie", and from interviews with representatives in 1995.

example. The environmental organizations stated, that all organochlorines should be considered to be toxic, persistent and biomagnifying substances until evidence to the contrary is provided (Greenpeace, 1994). This was called the "precautionary approach". This approach is needed, the environmental organizations argue, because it is clear that organochlorines often cause adverse environmental effects. Research on each individual substance is not possible as the industry produces at least 11,000 different organochlorines. Such an approach would take decades or longer while measures need to be taken immediately. The environmentalist frame, described in the first section, can be recognized at the background of this argument.

The Dutch chemical industry stated that organochlorine emissions should not be considered as wrong *per se* due to the presence of a chlorine atom (BLANKEN, 1995). Scientifically, it is not justifiable to extrapolate the effects of one specific chlorine substance to other ones because the chlorine family is a heterogeneous party. It is not fair to generalize the toxic effects of DDT[12] to the plastic PVC because DDT is a pesticide made to destroy insects. The industry pleaded for separate risk assessments for each organochlorine instead of putting all the chlorine substances in the same box. The pre-environmentalist frame can be detected at the background of this argument: uncertain effects are not a reason to act.

5 Using LCAs on PVC in the Discussion

Since 1989, approximately 20 Dutch LCAs on PVC have been made (e.g. ANINK, 1996; ANONYMOUS, 1995; BEENEN and EYGELAAR, 1993; FKS, 1995; GOEDKOOP and VOLMAN, 1991; HOEFNAGELS et al., 1992; LINDEIJER et al., 1990; RIJKE and KORENROMP, 1994; VERSPEEK et al., 1991; VNCI, 1991). These LCA reports presented ecoprofiles of PVC and their alternatives and rankings in a number of cases. A number of studies concluded that PVC had a higher environmental burden than other products, while other studies indicated the opposite. Reports often indicated that their results were not very certain. The conflicting and uncertain nature of the rankings and ecoprofiles are caused by differences in assumptions about the weight and material composition of products, life time of products, type of production processes used and type of waste management process used. In addition, different allocation models, classification models, standardizing procedures and methods to derive weight factors were used in these PVC studies.

Actors involved in the PVC discussion have referred to the outcomes of these LCAs. LCAs rankings and quantitative ecoprofiles were especially central in the argument to abstain from substitution of PVC products presented by the PVC and chlorine industries and the Ministry of Economic Affairs. Usually, their references to LCAs on PVC contain the following parts:

- The rankings and ecoprofiles of a LCA study show that PVC has a low environmental burden or is comparable to other products
- These conclusions are objective and scientific as they are based on an internationally accepted scientific methodology and conducted by a reliable institute
- An independent party has sponsored the study

In several instances, the PVC and chlorine industries referred to studies that were not able to rank the different products, as none of the products were better in every aspect. The chemical industries used the fact that a LCA was not able to make a ranking as argumentation for the decision to take no actions against PVC[13].

References to LCAs were less central in the argumentation of other actors. For example, environmental organizations based their argumentation for the replacement of PVC mainly on biological studies on specific species that showed effects on health. They referred only occasionally to LCAs that considered other products better for the environment than PVC; e.g. they referred in one of their campaigns to an LCA on PVC piping[14].

In general, actors acted as critics when references were made to LCAs that were not in line with their ideas and pointed to the methodological shortcomings and the lack of knowledge, using this tactic to undermine the authority of the rankings and ecoprofiles. They also used the fact that the conclusions of different LCAs on PVC often conflicted to reject conclusions. The following discussion between a representative of the chemical industries and a representative of the environmental organizations illustrates this[15]:

Actor E: There are many LCAs that indicate that chlorine free plastics are better for the environment.

Actor C: We do not view these LCAs to be evidence, they are assumptions. LCAs also provide opposite results.

Actor E: And these opposite LCAs are regarded as authoritative?

Actor C: A change to alternatives needs to be substantiated and this is very difficult using LCAs.

[12] dichlorodiphenyltrichloroethane

[13] The Belgium VITO (Vlaamse Instelling voor Technologisch Onderzoek) study did not draw final conclusions (BAERE et al., 1994). The chemical industries concluded that this VITO study proved that it was not beneficial for the environment to replace PVC by other materials. They stated that the study had proved that there where no environmental arguments for this (ANONYMOUS, 1994:4). Belgische onderzoekers spreken geen voorkeur uit voor glas of PVC, Chemisch Weekblad 29/30, 23 July 1994, p. 3.)

[14] SNM (Stichting Natuur en Milieu), 1993a. *Geen PVC buis in en om het huis*, Utrecht: SNM, 2 februari (appendix to a press report).

[15] Workshop PVC, Technical University Delft, 23 February 1996.

Evidence from LCAs was also rejected because it was charged that clients and steering groups were able to influence the outcomes of studies. Representatives of the Ministry of the Environment referred to the fact that the LCA sponsored by the branch association of concrete producers[16] concluded that concrete was better than PVC while the branch association of the producers of plastic pipes concluded that concrete and PVC had approximately the same environmental burden[17].

In practice, the use of LCA conclusions led to polarized and simplified discussions and arguments: "PVC is good versus PVC is bad" or "the study is right versus the study is wrong". This shows that transparent presentation of the methodology used and of remaining uncertainties does not generally lead to a communicative discussion between political actors on the real issues. In general, actors that referred to LCAs results were not able to convince actors holding other perceptions on the level of the environmental burden of PVC.

6 Making Play with the Chlorine Balance

In 1995, Margaretha de Boer, the Dutch Minister of Environment, wrote a policy memorandum[18] and forwarded it to the Standing Committee of Housing, Spatial Planning and Environment of the Dutch Parliament[19]. In it, she explained that a specific chlorine policy was not required because "the risks of chlorine and chlorine substances were under control"[20]. The Minister proposed only a number of small adaptations to the current chlorine and PVC industry, which is quite the opposite of the environmental movement's position.

The Minister substantiated her conclusion that "the risks of chlorine and chlorine substances were under control" with an ecoprofile taken from the report *A Chlorine Balance for the Netherlands* (→ *Table 2*; TUKKER et al., 1995a, b, and c; KLEIJN et al., 1997). The Minister drew this conclusion from the study although the studies conductors stated in the preface to it that it did not, however, provide a complete basis to conclude whether the risks of the chlorine chain were acceptable due to the lack of knowledge and the relative nature of the conclusions (TUKKER et al., 1995a: xvi, 67). The Minister did not provide additional arguments from other sources.

Although the Minister concluded that the problems of chlorine were relatively small, she expressed her concerns about a number of substances as the Chlorine Balance reports had shown that a few substances exceeded governmentally defined Maximum Tolerable Risk[21] levels in a number of situations. She formulated actions for these substances. In addition, the Minister formulated actions to reduce the problems of processes and products that caused more than 85% of the total chlorine chain contributions to each environmental impacts according to the Chlorine Balance report (→ *Table 3*).

The Minister expressed her concern about a number of knowledge gaps and proposed that further research should be done in these fields. The proposal of the ministry was accepted by the Dutch Parliament[23] and will be implemented in the near future.

Table 2: Contribution of the chlorine chain as percentage of the total Dutch environmental burden in 1990 and after implementation of the policy measures arranged per 1-1-1995

Environmental theme	Contribution in 1990 (as percentage of the total environmental burden in 1990)	Contribution after implementation of the policy measures arranged per 1-1-1995 (as percentage of the total environmental burden in 1990)
Greenhouse effect	12	1
Ozone depletion	65	5
Acidification	0.6	0.04
Human toxicity	0.6	0.2
Ecotoxicity	12	7
Waste dump	0.2	0.2
Smog formation	0.2	0.1
Smell	0.02	0.003

Source: TUKKER et al. (1995a: viii); Score of ecotoxicity is uncertain

The chemical industries agreed with the Ministers proposal and her interpretation of the Chlorine Balance. The environmental organizations argued, however, that the report

[16] Vereniging van Producenten van Betonleidingsystemen (VPB) (1995): INTRON 1995
[17] FKS (1995)
[18] BOER, DE M. (Minister van VROM) (1995): Letter to the chair of the Standing Committee of Housing, Spatial Planning and Environment of the Dutch Parliament, DGM/SVS/950211484, 21 November
[19] Vaste Commissie Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer van de Tweede Kamer der Staten-Generaal.
[20] Risico's chloor en chloorverbindingen beheersbaar
[21] Maximaal Toelaatbaar Risico
[22] Bijlage 1. Belangrijkste conclusies uit het rapport "Een chloorbalans voor Nederland". (Appendix 1. Main conclusions of the report "A chlorine balance for the Netherlands").
[23] The proposal was discussed by the Standing Committee of Housing, Spatial Planning and Environment of the Dutch Parliament.

Table 3: Products and processes that cause more than 85% of the total contribution of the chlorine chain after implementation of the policy measures fixed per 1-1-1995

Environmental theme	Products and processes
Greenhouse effect	CFCs emitted from consumed foam and HCFCs and CFCs from a number of other essential applications
Ozone depletion	CFCs emitted from consumed foam and HCFCs and CFCs from a number of other essential applications
Acidification	Production of 1,2-dichloroethane, PVC and waste management
Human toxicity	Use of a number of products, e.g. EDC in pharmaceuticals and the production of EDC/PVC
Ecotoxicity (aquatic)	Use of pesticides and biocides
Waste dump	Waste from PVC products
Smog formation	Use of dichloromethane and trichloroethane
Smell	Use of PER (tetrachloroethane) and trichloroethane

Source: TUKKER et al. (1995: ix); Appendix to the letter of the Minister[22]

did not prove that the risks of chlorine were limited, as many effects that could not be quantified were set aside. These effects are strong arguments against the use of chlorine from a precautionary perspective. At present, the Dutch discussion about the uncertainties of organochlorines and especially the hormonal effects continues: however, the Minister of the Environment did neither take the precautionary principle into account in the design of chlorine policies nor did she rebut it in her defense of the policy proposal.

7 Rational Features Hamper an Open and Communicative Discussion

Reasoning from a discoursive perspective, it is not a problem that the LCAs on PVC did not yield objective, conclusive rankings and ecoprofiles. This is inherent to the complexity of the situation studied, the plausibility of different human interpretations and the fact that evaluations[24] are necessarily based on normative considerations. Studies with different outcomes represent different perceptions on the environmental burden of PVC.

The problem is, however, that LCAs on PVC did not provide an adequate discussion basis and even hampered an open and communicative discussion in some cases. Three limitations of LCAs as discussion basis are described below and it is argued that these problems are related to LCAs rational features such as their formal and quantitative orientation. The main problems with LCAs and their causes are summarized in **Table 4**.

The first problem is that the LCA methodology and LCAs framed or structured the issue of the environmental burden of PVC in a specific way. This may appear strange at first sight since one might interpret the LCA methodology as a flexible framework that can be used to study all kinds of products and all kinds of environmental effects. Each actor or scientist is free to add his own environmental goals or environmental models to the framework. This is true, but this possibility does not enable the LCA methodology to accommodate each imaginable perception because the methodology and studies contain implicitly a pre-environmentalist frame on toxicity: uncertain effects that cannot be quantified are not a reason to act[25]. The pre-environmentalist frame is caused by LCA's emphasis on quantitative effects. Uncertain effects that cannot be proven in a formal, quantitative way, such as the effects of additives, bio-accumulation and hormonal disrupting effects, are not considered in drawing up ecoprofiles and rankings (→ *Table 5*). Uncer-

Table 4: Problems of LCAs in public policy making and their main causes

Problem	Main causes
Implicit pre-environmentalist frame	Emphasis on quantitative effects, formal proof, certain effects
Low input for a communicative discussion	Ignorance of key issues due to pre-structured approach
	Justifying arguments not given or not transparent due to formal approach and failure to reflect on frames and values
Polarized use of LCAs	Apparent objectivity
	Simple, quantitative results
	Black box nature of formal methods

[24] The very term "evaluation" is linguistically rooted in the term "value" (GUBA and LINCOLN, 1989: 34)

[25] TUKKER stated in his article on LCAs on PVC that the designers of LCAs have implicitly chosen for one specific evaluative frame (TUKKER, 1997).

Table 5: Conceptualization of the environmental burden of PVC used for the LCA methodology versus the conceptualization of the environmental organizations

LCA methodology and PVC LCAs	Environmental organizations
Do not consider uncertain effects e.g. hormonal effects as an argument against PVC	Consider uncertain effects, e.g. hormonal effects as an argument against PVC
Neglect transformations of chlorine substances in the environment	Consider chlorine substances to be very reactive. Innocent chlorine substances are transformed into dangerous ones
Consider all emissions to be equally persistent. In addition they assume that all the emissions are spread homogeneously over the globe and its inhabitants	Consider organochlorine emissions to be very persistent and to be biomagnifying and argue that they therefore have much larger toxic effects than only toxic emissions
Most Dutch LCAs on PVC include neither transport risks, fire hazards, and other accidents nor their effects	Consider transport risks, fire hazards and other accidents as an important argument for the replacement of PVC. Mankind can not control a risky substance like chlorine
Most Dutch LCAs on PVC do not include the environmental effects of additives because it is very hard to calculate these	Consider additives, e.g. phthalates, to be very detrimental for the environment
Consider products with a high toxicity score acceptable when scores for other themes were low as they applied multi criteria analyses	Consider products that are toxic or made from toxic components as unacceptable even when they have, for example, a low energy requirement

tain effects are only used to qualify the formulated rankings and ecoprofiles but not to chose for certain actions against products. As a result the approach taken in the LCA methodology resembles the way the chemical industries framed the issue of replacement of PVC products, but does not match adequately with the environmentalists' frame[26]. The LCA methodology is thus not able to accommodate different frames and perceptions due to the standardized approach.

The fact that LCAs contain a frame is not very problematic from the discourse point of view because it is not possible to make sense of complex issues without the use of frames. The problem is mainly laid in the implicit nature of the frame in combination with the objectivity claim for LCAs results. In addition, it is a problem that environmental scientists have not developed methodologies that deal with uncertain effects and toxicity that matches the environmentalists' frame and that could support the environmentalists' case.

The second problem is that LCAs hardly contributed to a dialogue about different conceptualizations of the environmental burden of PVC and underlying frames. This is not very surprising when we look to the kind of information provided by LCAs. The information value of LCAs for those who want to keep a communicative dialogue going is rather low due to the emphasis placed on numerical outcomes and on technical, formal procedures over transparent, rich, balanced arguments. This had the following disadvantages:

- The conceptualization of the PVC issue by LCAs remained a black box for many policy makers, e.g. the members of the Dutch Parliament, because LCAs present their arguments in a formal and quantitative way.
- LCAs on PVC ignored most of the key conflicts in the PVC policy discussion, like the required level for persistent, toxic, and biomagnifying substances. This is caused by the pre-structured, instrumental approach of the LCA methodology and the fact that reflection on normative aspects and frames is not stimulated.
- LCAs did not justify their conceptualization and the underlying frame towards the actors in the discussion[27]. Choices were only defended in a technocratic, formal way. For example, one of the PVC LCAs[28] based the weight factors on the scarcity of environmental resources and stated that a German scientist developed this method. A real justification would explain why scarcity is important.

The third problem is the polarized use of LCA results. Of course one can accuse the actors involved of strategic use of the study results and consider this to be something that could happen to the results of any study (KLEIJN et al., 1996); however, it is plausible to conclude that a number of rational features make LCAs a powerful instrument for actors who want to hold a polarized and simplified argument.

The apparent objectivity gives LCAs too much authority and neglects that they are based on a specific frame and specific environmental goals. The proven rankings and ecoprofiles present a rather uncomplicated and absolute picture of the environmental burden of products and are consequently especially suitable for a simplified argument. Rankings and ecoprofiles even appear to be problematic when presented in a balanced way, e.g. with uncertainties mentioned. The PVC case shows that political actors suppressed or denied qualifications when the results were in line with their view. On the other hand, actors tended to emphasize these uncer-

[26] Environmentalists have, in general, challenged prevailing conventions on what legitimately counts as evidence and knowlegde relevant to policy processes (TESH, 1993; TORGERSON, 1997).

[27] Justificatory arguments are alien to the philosophy of the rational approach, as the approach was initially developed for policy decisions in which only one actor was involved and not for policy making in a network context. This unitary actor did not need to convince other actors, he only needed support to find the best means from his point of view.

[28] FKS (1995)

tainties when they did not agree with the results. Qualifications in LCAs often led to polarization about the quality of the study[29]. Apart from the apparent objectivity and the misplaced concreteness of LCAs' conclusions, there is another reason for LCAs' vulnerability to abuse. The formal methods used remain black boxes for not LCA experts and the results may be used to manipulate the public.

The Chlorine Balance case shows what happens when actors succeed in their polarizing strategy. The Minister won the discussion by using LCA results in an absolute way. This freed her from providing arguments about her conceptualization of the PVC issue and from rebutting the argument of the environmental organizations. Just like all the other LCAs on PVC, the Chlorine Balance study did not rebut the ideas of the environmentalists, as it ignored the key issues in the PVC and chlorine. This entailed that the problem conceptualization of the environmental organizations was pushed aside without a serious dialogue on the value of this conceptualization. This use of the Chlorine Balance reports reduced the open nature of the political discussion and hampered democratic ideals.

Policy makers should not use studies in a manipulative way. Measures at the level of the policy process may prevent manipulative behaviour and stimulate open communication processes. Any study can be misused by policy makers. Studies with rational features are however especially vulnerable for polarized use (TORGERSON, 1986). For this reason, it is desirable to change current LCA methodologies and the way studies are carried out.

8 Directions for Methodological Development

Authors working in the field of the discourse paradigm have started to outline an alternative study approach that contributes better to sound dialogues and learning processes. Elaborating on their work, the problems with LCAs might be solved by shifting the emphasis in LCAs and the LCA methodology from making formal calculations on a prestructured basis to a more open, emergent and qualitative study approach in which the conceptualization of issues and the development of rich and balanced arguments on normative and factual issues is central.

The proposed goals requires a major reorientation of the LCA methodology (BRAS and ENSERINK, 1997):

- It is valuable to add a new stage to the LCA methodology, between the goal definition stage and the calculation of the inventory table. In this stage, scientists and others structure the issue of the environmental burden in a conceptual or qualitative way. This improves the openness of the methodology and can be used to judge the value of the LCA research approach for the product studied.
- It is important that the new methodology stimulates the explication of values and frames underlying problem definitions and evaluations of alternatives in all the stages of the analysis. In this way, studies will also inform policy makers on values and frames and enable them to rate the results at their true value.
- It is recommended to shift the focus of the methodology to the development of balanced and rich arguments on policy problems and solutions that are transparent and relevant for other network actors. It is only possible to develop relevant arguments, when one investigates and studies the perceptions of other actors. A new methodology should support this activity.
- The new methodology should be able to accommodate more frames and perceptions and allow a discussion to be organized between the perceptions. The development of methodologies that contain one explicated frame is another option. In this case, it is relevant to develop a number of methodologies that represent the different frames present in society, e.g. a methodology that evaluates products from a precautionary perspective (TUKKER, 1997).
- Use of quantitative methods is not wrong *per se* but should not be overemphasized. Quantification is only valuable in specific situations, and it should be used as part of a verbal argument. Integral report marks for environmental burdens are not very valuable for public policy processes due to their lack of transparency.

It is expected that this reorientation will improve the value of the LCA methodology for public policy making. Studies based on this new methodology are less vulnerable to misuse by policy makers because they are explicitly normative, contain transparent arguments and do not ignore key issues. Issues that can not be quantified are no longer ignored but dealt with in a qualitative way. Other decision making contexts, e.g. formulating company policies or designing new products, will probably require other adaptations.

The proposal entails that the rational methodological division between the tasks of policy makers and scientists, between values and facts is no longer followed. Scientists will study factual aspects and normative aspects to provide input for a sound political discussion. In this discussion, the policy makers discuss both normative and factual issues. This is preferred above means-ends analyses that appear objective but are in fact value- and frame-dependent and do not provide input for a discussion on normative and frame aspects. To conclude, a citation from MAJONE (1989): "Since to say anything of importance in public policy requires value judgements, this artificial separation between values and rational capacities is a threat to all notions of public deliberation and defensible policy choices".

[29] The qualification of study results has, however, an important advantage. The PVC case shows that actors did not win the political discussion on the basis of references to LCAs because other network actors used the uncertainties and methodological qualifications to challenge conclusions of LCAs. As a result, actors were not able to remove other perceptions from the political communication process. At least, the PVC debate continued and remained accessible for different participants and arguments.

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